CLAIMS:

1. A variable-directivity antenna comprising:

an omnidirectional antenna element;

a transmission line connected to the antenna element; and

an electric field adjusting structure provided in a boundary region between the antenna element and the transmission line and configured to change electric field distribution of the transmission line to a desired direction.

2. The variable-directivity antenna of claim 1, wherein the boundary region is an area defined with respect to a connecting plane between the antenna element and the transmission line so as to avoid occurrence of resonance at an operating frequency of the antenna.

3. The variable-directivity antenna of claim 1, wherein at least a surface area of the antenna element is made of a conductive material, and the

antenna element has a gap formed in the conductive material and extending in the radial direction from a center of the antenna element.

4. The variable-directivity antenna of claim 1, wherein the electric field adjusting structure includes an electrical switch for changing the electric field distribution of the transmission line.

5. The variable-directivity antenna of claim 4,

wherein the transmission line includes a center conductor connected to the antenna element and an outer conductor around the center conductor; and

wherein the electric field adjusting structure includes two or more of the switches positioned in the boundary region, and at least one of the switches is used to cause short-circuit between the center conductor and the outer conductor at a predetermined position around the antenna element.

6. The variable-directivity antenna of claim 4,

wherein the transmission line includes a center

conductor connected to the antenna element and an outer conductor around the center conductor; and

wherein the electric field adjusting structure includes a plurality of floating conductor strips inserted between the center conductor and the outer conductor and two or more of the switches arranged in the boundary region, at least one of the switches being used to cause short-circuit between at least one of the floating conductor strips and the outer conductor at a predetermined position around the antenna element.

7. The variable-directivity antenna of claim 6, wherein the floating conductor strips have different lengths and are arranged alternately around the antenna element.

8. The variable-directivity antenna of claim 6, wherein the floating conductor strips include a first group of floating conductor strips with a first length arranged in the boundary region at a first position along a longitudinal axis of the transmission line, and a second group of floating

conductor strips with a second length arranged in the boundary region at a second position along the longitudinal axis of the transmission line.

9. The variable-directivity antenna of claim 6, wherein each of the floating conductor strips is furnished with a variable capacitor element.

10. The variable-directivity antenna of claim 4,

wherein the transmission line includes a center conductor connected to the antenna element, an outer conductor around the center conductor, and a dielectric material filling a space between the center conductor and the outer conductor; and

wherein the electric field adjusting structure includes two or more electrodes arranged at predetermined intervals around the center conductor, and a voltage is applied across at least one of the electrodes and the center conductor so as to vary a dielectric constant of the dielectric material at a predetermined position.

11. The variable-directivity antenna of claim 10, wherein the electrode is a comb electrode.

12. The variable-directivity antenna of claim 10, wherein the dielectric material is liquid crystal.

13. The variable-directivity antenna of claim 1, wherein the transmission line is a coaxial cable.

14. A method for controlling directivity of an antenna, the method comprising the steps of:

feeding a radio signal through a transmission line of the antenna; and

varying electric field distribution of the transmission line in a boundary region between the transmission line and an antenna element connected to the transmission line, such that the electric field distribution turns to a desired direction.

15. The method of claim 14, further comprising the steps of:

defining the boundary region with respect to a connecting plane between the antenna element and the transmission line so as to avoid occurrence of resonance at an operating frequency of the antenna;

providing a plurality of switches in the boundary region; and

causing a short-circuit between a center conductor and an outer conductor that form the transmission line using at least one of the switches at a predetermined position around the antenna element to turn the electric field distribution to a direction opposite to the short-circuited position.

16. The method of claim 14, further comprising the steps of:

providing a plurality of floating conductor strips between a center conductor and an outer conductor that form the transmission line;

providing a plurality of switches in the boundary region; and

causing a short-circuit between at least one of the floating conductor strips and the outer conductor using at least one of the switches at a predetermined position so as to turn the electric field

distribution to a direction opposite to the short-circuited position.

17. The method of claim 16, wherein the floating conductor strips with different lengths are prepared corresponding to different operation frequencies and are positioned around the center conductor in the boundary region, and the electric field distribution is turned to the desired direction at a selected operating frequency.

18. The method of claim 16, further comprising the steps of:

arranging a first set of the floating conductor strips with a first length in the boundary region at a first position along a longitudinal axis of the transmission line;

arranging a second set of the floating conductor strips with a second length in the boundary region at a second position along the longitudinal axis of the transmission line; and

changing the electric field distribution of the transmission line by causing a short-circuit between

a selected one of the floating conductor strips and the center conductor at one of first and second operating frequencies.

19. The method of claim 14, further comprising the steps of:

arranging a plurality of electrodes at predetermined intervals around the center conductor of the transmission line; and

applying a voltage across at least one of the electrode and the center conductor to change a permittivity of a selected portion of a dielectric material filling a space between the center conductor and the outer conductor in order to turn the electric field distribution to the desired direction.

20. The method of claim 19, wherein the permittivity of the dielectric material is increased at the selected portion upon application of the voltage, and the electric field distribution is turned to a direction of the selected portion with the increased permittivity.

21. The method of claim 19, wherein the electrodes are comb electrodes, equivalent impedance of the selected portion of the dielectric material is changed upon application of the voltage, and the electric field distribution is turned to a direction opposite to the selected portion.